

REMARKS

I. INTRODUCTION

Favorable reconsideration of this application, in light of the present amendments and the following discussion, is respectfully requested.

II. STATUS OF THE CLAIMS

Claims 13-15 and 17-21 are pending, of which claims 13 and 18 are independent. Claims 1-12 and 16 are cancelled without prejudice. By this amendment, claims 13, 17 and 18 are amended. Support for the amendment can be found, for instance, on page 7 of the substitute specification. It is respectfully submitted that no new matter is added by this amendment.

III. SUMMARY OF THE OFFICE ACTION

In the outstanding Office Action, claims 13-21 are rejected under 35 U.S.C. § 112, first paragraph as failing to comply with the enablement requirement; Claims 13-21 are also rejected under 35 U.S.C. § 102(b) as being anticipated by Montalvo (U.S. Patent No. 4,083,663).

IV. THE REJECTIONS OF THE CLAIMS

A. The Rejection of Claims 13-21 under 35 U.S.C. § 112, first paragraph

Claims 13-21 are rejected under 35 U.S.C. § 112, first paragraph as failing to comply with the enablement requirement. For the reasons discussed below, this rejection is respectfully traversed.

It is respectfully submitted that one skilled in the art of combustion engines would understand how a working medium is transferred from one chamber to another chamber. One skilled in the art would also understand how a chamber decreases or increases its volume with the motion of a piston. Furthermore, the description of the present invention in the

remarks below will further explain the invention. Accordingly, it is respectfully requested that this rejection be withdrawn.

B. The Rejection of Claims 13-21 under 35 U.S.C. § 102(b)

Claims 13-21 are rejected under 35 U.S.C. § 102(b) as being anticipated by Montalvo. For the reasons discussed below, this rejection is respectfully traversed.

Briefly, Montalvo does not disclose, teach or suggest the step of supplying heat to the work medium when the work medium passes through the third stage chamber, as recited in the claimed invention. Moreover, Montalvo does not disclose, teach or suggest an apparatus wherein the largest volume of the first stage chamber is larger than the largest volume of the second stage chamber, the largest volume of the fifth stage chamber is larger than the largest volume of the fourth stage chamber, and the largest volume of the fifth stage chamber is larger than or equal to the largest volume of the first stage chamber, as recited in independent claim 18.

As amended, independent claim 13 recites a 5-stroke process for converting heat energy into mechanical energy comprising, among others, the steps of: transferring the work medium from the second stage chamber through a third stage chamber to a fourth stage chamber, and supplying heat to the work medium when it passes through the third stage chamber.

Independent claim 18, as amended, recites an apparatus for converting heat energy into mechanical energy comprising five in-line separate stage chambers, linked together by channels. The first, second, fourth and fifth chambers have variable volumes, wherein the first chamber is larger than the second chamber, the fifth chamber is larger than the fourth chamber, and the fifth chamber is equal to or larger than the first chamber. The third stage constitutes a chamber of constant volume. Furthermore, claim 18 recites that the piston of

the second chamber is connected by a shaft to the piston of the fourth chamber, and the piston of the first chamber is connected by a shaft to the piston of the fifth chamber.

Attached as an appendix to this paper are two drawing figures that show alternative exemplary configurations of the present invention. As shown in the figures, the compression takes place during displacement from the larger chamber 1 to the smaller chamber 2, and the expansion takes place during displacement from the smaller chamber 4 to the larger chamber 5. The system also includes a separate third stage chamber 3 connected between the second chamber 2 and the fourth chamber 4, wherein heat is supplied to the work medium as the work medium passes through the third stage chamber 3.

Montalvo does not disclose, teach or suggest at least the aforementioned features of claims 13 and 18. Montalvo discloses a car engine with a basic 4-stroke version: 1) intake; 2) compression; 3) expansion; and 4) exhaust. Figs. 27-41 of Montalvo show that the engine has two stators 88a-88b, each with one central piston 70 and three rotary sliding valves 72. Each working cycle is executed in one of the stators as follows: Intake (Figs. 27-29) takes place in the first stator 88a. After the opening of channel 101 by movement of the rotary sliding valve 72b (Fig. 29), the air will be displaced to the second stator 88b via the rotary sliding valve 72d. With the air having been displaced to the stator 88b, the valve 72d (Fig. 32) will be closed. Then the second working cycle, i.e., displacement of air into the compression chamber, will begin in the stator 88b with parallel fuel injection through nozzle 102 (Fig. 33). With the air having been compressed, the intake orifice of the compression chamber will be closed and the air/fuel mixture will be ignited with the spark generated by spark plug 103 (Fig. 34). Heat will be generated by combustion and, at the same time, the exhaust orifice of the compression chamber will be opened and the third cycle, i.e., expansion, will start (Fig. 35). However, the expansion will not be completed because it will

be interrupted after the opening of the channel 100 by movement of the sliding valve 72e (Figs. 36-37). Then, additional burning will take place after supplying oxygen (Fig. 38) and the work medium will come back to the stator 88a. Thereafter, the fourth cycle, i.e., additional expansion, will begin (Fig. 40). The fifth cycle, i.e., exhaust, is shown in Fig. 41.

As such, Montalvo discloses a 4-stroke engine with heat introduced into the air/fuel mixture between the compression and power strokes. As heat cannot be introduced instantly and requires a period of time for fuel combustion passing through heat exchanger walls, and, as the time required for change in piston movement direction or the time between closing the intake valve and opening the exhaust valve of the engine as specified in Montalvo is too short, due to applicable kinematics, certain losses in compression and expansion times must be accepted, i.e. totally 20° to 50° of shaft rotation, depending on shaft speed. Moreover, the compression heat causes a steep increase in pressure, hence, plenty of heat will be diverted to expansion. However, this phenomenon reduces expansion time and increases exhaust pipe pressure which, in turn, reduces thermodynamic efficiency. As a result, in Montalvo, a separate heat supply time cannot be included. Therefore, Montalvo does not have, and cannot have, the third chamber with heat being supplied to the work medium while passing through the third stage chamber, as recited in claim 13.

Moreover, Montalvo is not concerned with the sizes of the chambers, as recited in claim 18. As shown in Figs. 27-41 of Montalvo, all essential working cycles take place in one cylinder or stator 88, and the chambers that contain the rotors 72 have the same size. Therefore, Montalvo does not teach or suggest an apparatus comprising first through fifth chambers having the volume relationships and connections as recited in claim 18.

In view of the discussions above, it is respectfully submitted that independent claims 13 and 18 are not anticipated by Montalvo. Dependent claims 14-15, 17 and 19-21 are also

believed to be allowable over Montalvo for the same reasons. Therefore, the rejection of claims 13-15 and 17-21 under 35 U.S.C. § 102(b) over Montalvo is respectfully requested to be withdrawn.

V. CONCLUSION

Consequently, in view of the foregoing discussion and present amendments, it is respectfully submitted that this application is in condition for allowance. An early and favorable action is therefore respectfully requested.

Please charge any shortage of fees or credit any overpayment thereof to BLANK ROME LLP, Deposit Account No. 23-2185 (124166-00101). In the event that a petition for an extension of time is required to be submitted herewith and in the event that a separate petition does not accompany this report, Applicant hereby petitions under 37 C.F.R. §1.136(a) for an extension of time for as many months as are required to render this submission timely. Any fee due is authorized above.

Respectfully submitted,

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APPENDIX



